

# PACKAGE STRUCTURE OF AN IMAGE SENSOR AND METHOD FOR PACKAGING THE SAME

## BACKGROUND OF THE INVENTION

### Field of the invention

5       The invention relates to a package structure of an image sensor and method for packaging the same, in particular, to a package structure of an image sensor, which is formed by way of flip chip bonding and capable of simplifying the manufacturing processes and lowering the manufacturing costs.

### Description of the related art

10       A general sensor is used for sensing signals, which may be optical or audio signals. The sensor of the invention is used for receiving image signals and transforming the image signals into electrical signals which are transmitted to a printed circuit board.

15       Referring to FIG. 1, a conventional image sensor includes a substrate 10, a spacer 18, an image sensing chip 22, and a transparent glass 28.

      The substrate 10 is made of ceramic materials. A plurality of signal input terminals 12 and signal output terminals 14 are formed on the periphery of the substrate 10. The signal output terminals 14 are used for electrically connecting the substrate 10 to a printed circuit board 16.

20       The spacer 18 is arranged on the substrate 10 to form a chamber 20 above the substrate 10.

The image sensing chip 22 is mounted on the substrate 10 and within the chamber 20 surrounded by the substrate 10 and the spacer 18. The substrate 10 is electrically connected to the image sensing chip 22 by a plurality of wirings 24 that electrically connects the bonding pads 26 of the image sensing chip 22 to the signal input terminals 12 of the substrate 10, respectively.

The transparent glass 28 is mounted on the spacer 18 so that the image sensing chip 22 can be protected and receive image or optical signals travelling through the transparent glass 28. The image signals are then transformed into electrical signals which is to be transmitted to the signal input terminals 12 of the substrate 10. The electrical signals are transmitted from the signal input terminals 12 of the substrate 10 to the signal output terminals 14, and then, from the signal output terminals 14 to the printed circuit board 16.

The above-mentioned package structure of the image sensor has a lot of elements and has a lot of complicated manufacturing processes. Moreover, since the substrate 10 is made of ceramic materials, the manufacturing costs are high. Furthermore, since the ceramic materials cannot be easily cut, the substrates 10 must to be manufactured one by one, which also increases the manufacturing costs.

To solve the above-mentioned problems, it is necessary for the inventor to provide a package structure and method for an image sensor, in order to facilitate the manufacturing processes and to lower the manufacturing costs.

## SUMMARY OF THE INVENTION

It is therefore an object of the invention to provide a package structure of an image sensor capable of reducing the number of package elements and lowering the package costs.

It is therefore another object of the invention to provide a method for packaging an image sensor, which is capable of simplifying and facilitating the manufacturing processes.

To achieve the above-mentioned objects, the invention is characterized in that the image sensing chip is directly packaged under the transparent layer by way of flip chip bonding. Thus, the substrate for signal transmission is no longer needed.

According to one aspect of the invention, a package structure of an image sensor for electrically connecting to a printed circuit board includes a transparent layer and an image sensing chip. A plurality of signal input terminals and signal output terminals are formed on the transparent layer. The signal output terminals are used for electrically connecting the transparent layer to the printed circuit board. A plurality of electrical circuits are formed on the image sensing chip. Each of the electrical circuits is formed with bonding pads and is electrically connected to the transparent layer by way of flip chip bonding. The bonding pads are electrically connected to the signal input terminals of the transparent layer. The image sensing chip receives image signals via the transparent layer, converts the image signals into electrical signals, and transmits the electrical signals from the signal output terminals of the transparent layer to the printed

circuit board. A method for packaging the image sensor is also provided.

Thus, the packaging costs of the image sensor can be lowered and the packaging processes of the image sensor can be simplified.

#### BRIEF DESCRIPTION OF THE DRAWINGS

5        FIG. 1 is a cross-sectional view showing a conventional package structure of an image sensor.

FIG. 2 is a cross-sectional view showing a package structure of an image sensor in accordance with an embodiment of the invention.

10       FIG. 3 is a cross-sectional view showing a method for packaging the structure of the image sensor of the invention.

#### DETAIL DESCRIPTION OF THE INVENTION

Referring to FIG. 2, the package structure of an image sensor of the invention includes a transparent layer 30, an image sensing chip 40, and a glue layer 50.

15       The transparent layer 30 may be a transparent glass, which has a first surface 32 and a second surface 34. A plurality of signal input terminals 36 are formed on the first surface 32 by way of wire plating. Also, a plurality of signal output terminals 38 are formed on the second surface 34. The signal input terminals 36 extend from the periphery of the first surface 32 of the transparent  
20       layer 30 to the second surface 34 so as to electrically connect to the signal output terminals 38.

The image sensing chip 40 has an upper surface 42 and a lower surface 44. A plurality of electrical circuits are formed on the upper surface 42. Each of the electrical circuits is formed with bonding pads 46 that are electrically connected to the transparent layer 30 by way of flip chip bonding. Thus, the bonding pads 46 are electrically connected to the signal input terminals 36 formed on the first surface 32 of the transparent layer 30. At this time, the image sensing chip 40 can receive image signals via the transparent layer 30. Then, the image signals are converted into electrical signals and transmitted to the signal input terminals 36 of the transparent layer 30.

Furthermore, a plurality of gold bumps 48 are formed on each of the bonding pads 46 of the image sensing chip 40. Thus, the image sensing chip 40 can be electrically connected to the signal input terminals 36 of the transparent layer 30, and the image sensing chip 40 can be adhered to the transparent layer 30 by an adhesive glue layer.

The glue layer 50 are filled in the electrical connecting portion between the image sensing chip 40 and transparent layer 30 so as to protect the image sensing chip 40 and the transparent layer 30. Alternatively, the transparent layer 30 also can be firmly adhered onto the image sensing chip 40.

Referring to FIG. 3, the method for performing the package structure of the image sensor of the invention will be described. First, a printed circuit board 52, on which a plurality of electrical circuits (not shown) are formed, is provided. Each of the electrical circuits is formed with contact points 54 and a slot 56 in the

central portion.

The signal output terminals 38 formed on the second surface 34 of the transparent layer 30 are electrically connected to the contact points 54 of the printed circuit board 52, respectively, after the image sensor is packaged. The  
5 transparent layer 30 is located under the slot 56. Thus, the image sensing chip 40 can receive the image signals travelling from the slot 56 and penetrating the transparent layer 30, convert the image signals into electrical signals, and transmit the electrical signals to the signal input terminals 36 on the transparent layer 30. The electrical signals can be transmitted from the signal input terminals 36 and  
10 the signal output terminals 38 to the printed circuit board 52.

The packaging method of the invention includes the steps of:

providing a transparent layer 30 such as a transparent glass, which is formed with signal input terminals 36 and signal output terminals 38 by way of wire plating;

15 providing an image sensing chip 40 on which a plurality of electrical circuits are formed, each of the electrical circuits being formed with bonding pads 46 which are electrically connected to the signal input terminals 36 of the transparent layer 30 by way of flip chip bonding, the image sensing chip 40 thus being capable of receiving image signals via the transparent layer 30, converting  
20 the image signals into the electrical signals, and transmitting the electrical signals to the signal input terminals 36 of the transparent layer 30; and

providing a glue layer 50 filled in the electrical connecting portion between the image sensing chip 40 and the transparent layer 30 so as to protect the image sensing chip 40 and the transparent layer 30 and firmly adhere the transparent layer 30 to the image sensing chip 40.

5           As a result, the package structure and the method have the following advantages.

1. Since the transparent layer 30 is used as the signal transmission medium for the image sensing chip 40, the substrate 10 in the prior art can be omitted, and the packaging costs can also be lowered.

10           2. Since the substrate 10 can be omitted, the package volume can be made thin, small, and light.

3. Since the image sensing chip 40 is directly electrically connected to the transparent layer 30 by way of flip chip bonding, the manufacturing processes can be simplified, and the manufacturing costs also can be lowered.

15           While the invention has been described by way of example and in terms of preferred embodiments, it is to be understood that the invention is not limited to the disclosed embodiments. To the contrary, it is intended to cover various modifications. Therefore, the scope of the appended claims should be accorded the broadest interpretation so as to encompass all such modifications.

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